L9: Entry 3 of 5 File: USPT Nov 4, 2003

DOCUMENT-IDENTIFIER: US 6643650 B1
TITLE: Mechanism and apparatus for using messages to look up documents stored in spaces in a distributed computing environment

Detailed Description Text (7):
Messaging layer 104 sits on top of a message capable networking layer 106. In a preferred embodiment, messaging layer 104 does not require that a particular networking protocol be used. TCP/IP and UDP/IP are examples of message capable protocols that may be used for message capable networking layer 106. However, other more specialized protocols such as the Wireless Application Protocol (WAP) may also be used. Other possible message protocols are IrDA and Bluetooth network drivers beneath the transport layer. Networking layer 106 is not limited to a single reliable connection protocol, such as TCP/IP. Therefore, connection to a larger variety of devices is possible.

Detailed Description Text (78):
For example, as illustrated in FIG. 13, a client may be a conventional browser 400 that does not support gates to participate directly in the messaging scheme described above. The browser 400 may be aided by a proxy servlet (agent) 402. The browser user may use a search engine to find a Web page that fronts (displays the contents of) a space advertising services within the distributed computing environment. The user is able to point and click on the space Web page and, with the help of the servlet, to access services. The Web pages may include scripts, for example, Java or WML scripts, which may be used in connecting the browser to the proxy servlet. Scripts may also be used to send messages to the proxy servlet. The servlet agent may translate Web page actions into messages on behalf of the browser client. These actions may include navigating a space, starting services, and returning results. Result page URIs (referencing pages containing XML) may be returned directly (or translated into HTML or WAP if needed) to the browser, for display to the user. Thus, the browser-based client does not need to know how to start services, nor which messages to send during the service usage session. For example, a user of a WAP browser (e.g. on a cell phone) may connect to a space page, browse its contents (services), and then start a service, all by pointing and clicking. The agent 402 provides the client interface between the conventional client and the distributed computing environment.

Detailed Description Text (79):
The distributed computing environment may include several different types of message gates for communicating between clients and services that support different features. For example, as discussed above, some gates may support flow control or billing. Another type of message gate may support a form of remote method invocation. This type of gate may be referred to as a method gate. FIG. 14 illustrates the use of a method gate to provide a remote method invocation interface to a service. Method gates provide a method interface between clients and services. A method gate may be bidirectional, allowing remote method invocations from client to service and from service to client. A method gate 172 may be generated from XML schema information 170 (e.g. from a service advertisement in a space). The XML schema information 170 includes XML defining a method interface(s). From this information, code may be generated as part of the gate for interfacing to one or more methods. Each method invocation (e.g. from a client application 176) in

the generated code may cause a message to be sent to the service containing the marshaled method parameters. The message syntax and parameters to be included may be specified in the XML schema. Thus, the method gate 172 provides an XML message interface to remotely invoke a service method. The method gate may be generated on the client or proxied on a server, such as the space server where the service method was advertised or a special gateway server.

Detailed Description Text (398):
In one embodiment, a mobile client device may include Global Positioning System (GPS) capability and wireless connection technology. Local distributed computing networks may be provided. For example, a city may provide a citywide distributed computing environment. Another example may be a shopping mall with a local distributed computing environment. A local distributed computing network may include a discovery mechanism to allow client devices to connect to the distributed computing environment and to discover services and data in the local environment. For example, one or more devices in the environment may include wireless connection technology to allow mobile client devices to connect to the network and to access the discovery mechanism via the XML messaging system as described previously. A local distributed computing environment may include one or more spaces with advertisements for services and/or data to be made available to mobile clients. For example, a citywide distributed computing environment may include spaces that represent entities such as malls, movie theaters, local news, local weather, traffic, etc. A space may include individual service and/or data advertisements for accessing services of and information about the entity the space represents. The discovery mechanism may include a GPS location or locations of the local distributed computing environment, entities represented by space services within the environment, and/or the various services advertised in the spaces in the environment.

Current US Original Classification (1):
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Current US Cross Reference Classification (6):
709/218

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(10) **Patent No.: US 6,643,650 B1**
(45) **Date of Patent: Nov. 4, 2003**

(54) **MECHANISM AND APPARATUS FOR USING MESSAGES TO LOOK UP DOCUMENTS STORED IN SPACES IN A DISTRIBUTED COMPUTING ENVIRONMENT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 351 days.

(21) Appl. No.: **09/660,548**

(22) Filed: **Sep. 12, 2000**

Related U.S. Application Data

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(51) **Int. Cl.**[7] **G06F 17/30**; G06F 17/60; G06F 15/00

(52) **U.S. Cl.** **707/10**; 707/4; 707/104.1; 705/7; 705/14; 709/203; 709/218

(58) **Field of Search** 705/14, 7; 707/3, 707/4, 10, 104.1; 709/203, 218

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(57) **ABSTRACT**

A system and method for searching for documents within spaces in a distributed computing environment are provided. A client sends a lookup message to a space which stores documents. The lookup message may specify desired characteristics, such as a name or partial XML schema, of the stored documents. The documents may include XML service advertisements and XML device advertisements as well as general-purpose XML documents. A set of zero or more documents which match the lookup message are discovered. In one embodiment, the lookup message may include a desired name. If the lookup message includes both a desired name and a desired schema, the set of discovered documents may include both discovered documents having a name that matches the desired name and discovered documents having a schema that matches the desired schema. If the lookup message includes neither a desired name nor a desired schema, the set of discovered documents may include substantially all the documents stored in the space. After the matching documents are found, the space may send a lookup response message to the client. For each discovered document, the lookup response message may include a name and an advertisement. Each advertisement may include information which is usable by the client to obtain the respective discovered document or access the resource (e.g., a service) that the document advertises. The advertisements and messages may be expressed in a data representation language such as XML.

46 Claims, 45 Drawing Sheets

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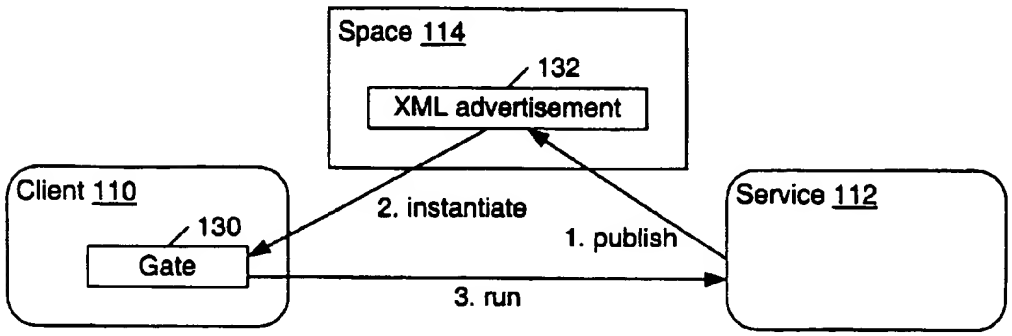

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